

Step Rate Test

UT 29-12 Injector

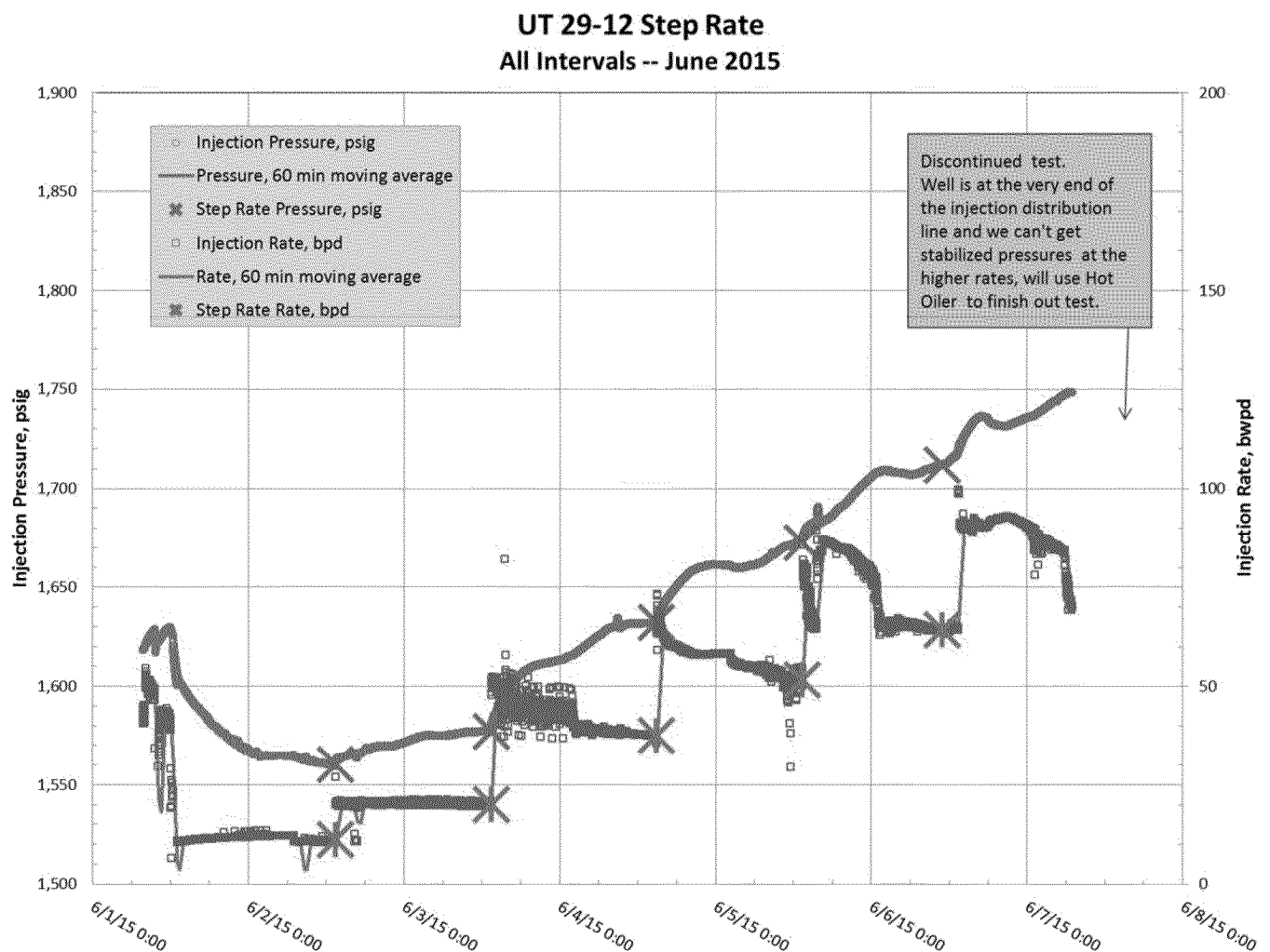
Antelope Creek Field

Duchesne County, UT

EPA Permit #: UT2736-00000

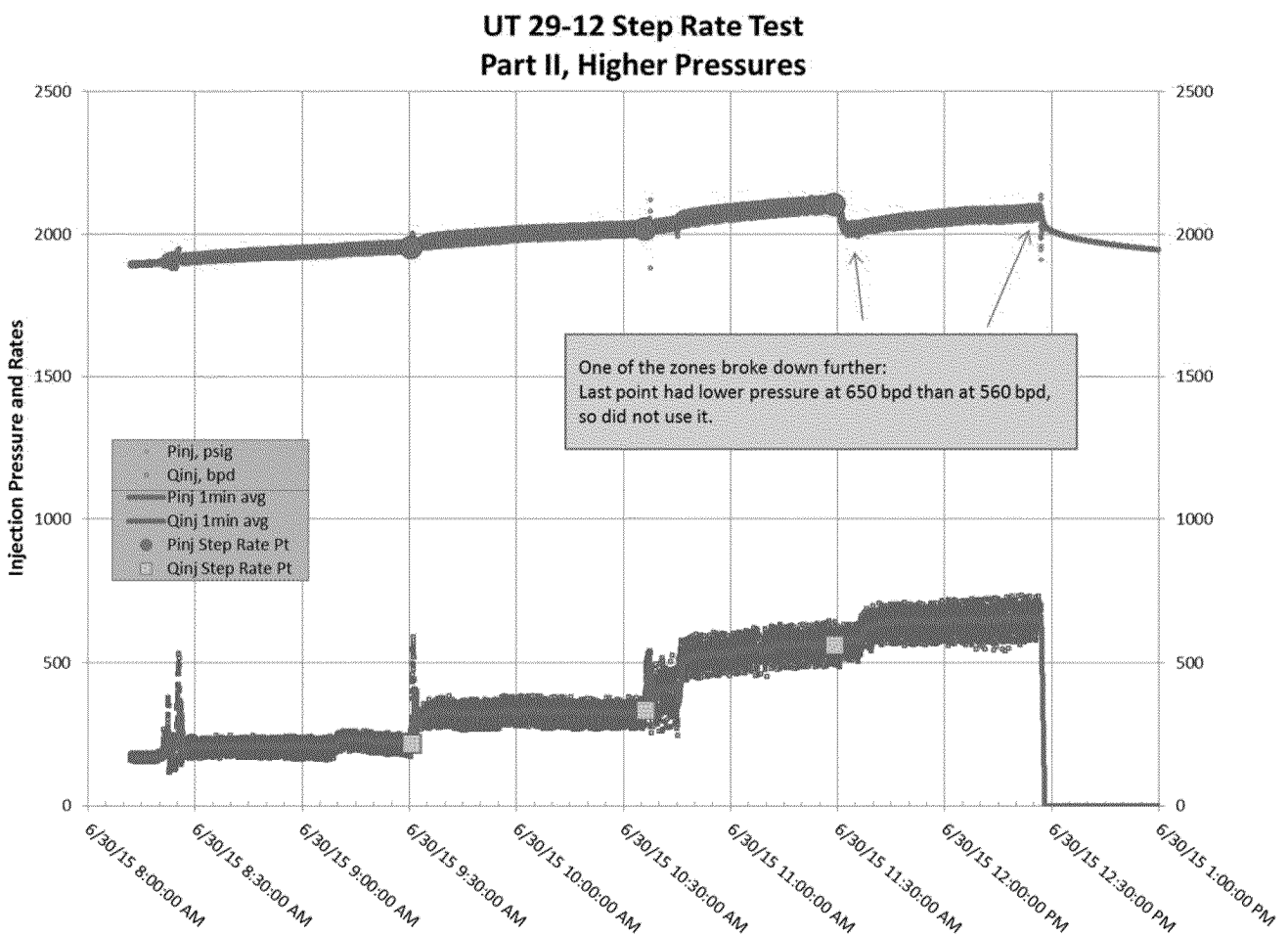
On May 12, 2015, Petroglyph Energy began a workover on the UT 29-12 Injector. As part of that workover, we added new perforations within the permitted injection interval, but above the present perforations, necessitating a new step rate test to determine the maximum allowed injection pressure.

Historically in Antelope Creek, it has been hard to obtain stabilized step rate points using constant one hour pumping intervals. This is due to the fact that at low rates (below the fracture gradient) it takes significantly longer for the rate and pressure to stabilize than one hour. To address that, we used our injection facility to pump the initial points and allowed the rate and pressure to stabilize over 24-hour periods, resulting in much better data:



Since the UT 29-12 is located at the end of the injection distribution system, we were limited to rates of approximately 65 bwpd, but five good stabilized points were obtained below the fracturing point. At this point the well was shut-in and injection stopped until we could line up a hot oiler that could steadily pump at rates under 0.5 bpm (<720 bpd).

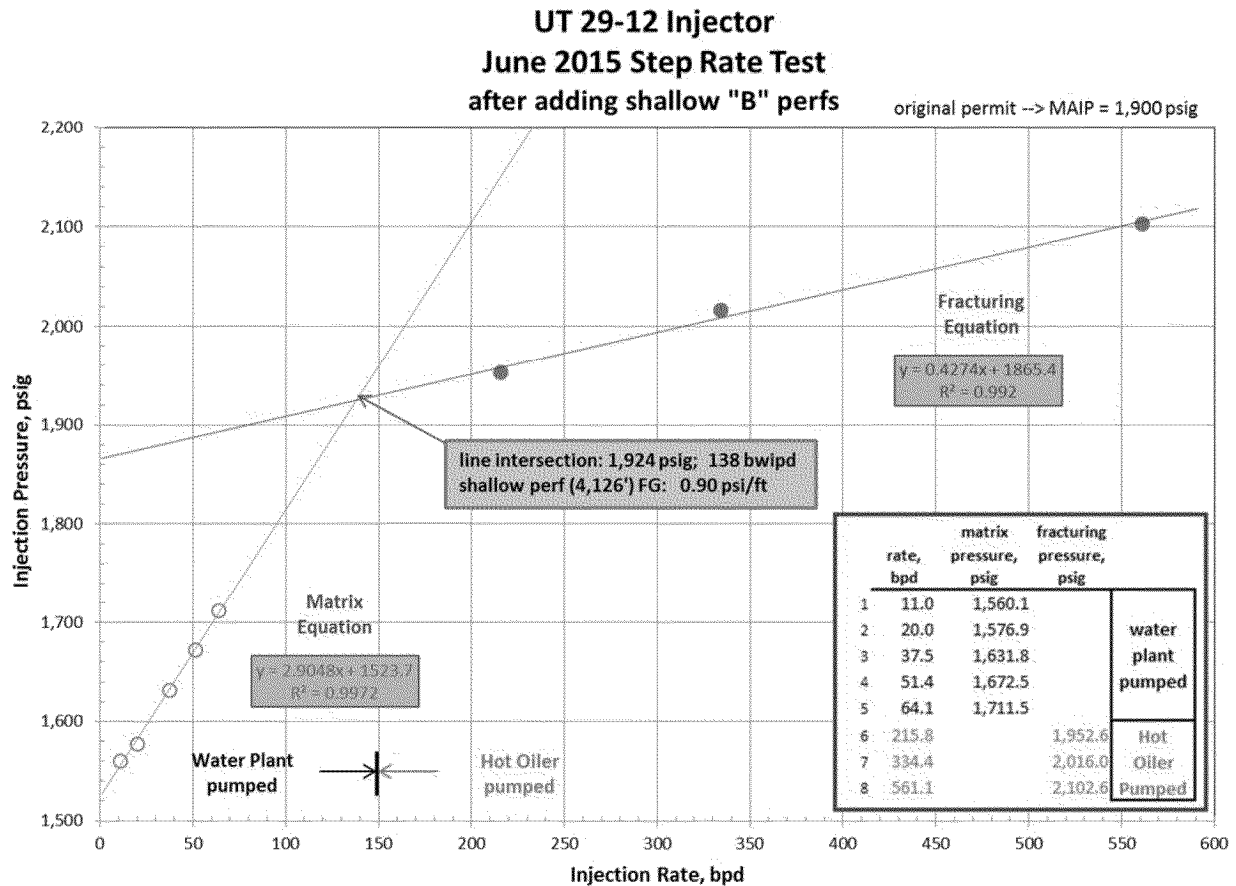
It took us a few weeks to locate a hot oiler that could steadily pump at lower rates. Once we did, we initiated minimal injection, using the water plant, at 25 bwpd for 24 hours prior to starting the second portion of our step rate test where we used the hot oiler to obtain pressure points above the fracturing gradient. Once the well began fracturing, it was much easier to obtain stabilized rates and pressures, and one hour pumping increments were adequate to obtain three points above the fracturing point.



All data was recorded using an electronic Halliburton meter. The data, logged using the water plant as the pumping device, was recorded on one minute increments. When we used the hot oiler, we recorded data on one second increments due to the shorter pumping intervals.

The resultant step rate plot indicates a fracturing point intersection at:

- 1,924 psig
- 138 bwipd



The R^2 of both the Matrix and Fracturing lines is >0.99 indicating extremely good data agreement and a good test. A spreadsheet with the data and graphs is attached.

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